What's Your Irrigation Distribution Uniformity?

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Michael Voigt reminds us of the importance of irrigation audits in the June 2011 issue of *Golf Course Management* (You Can't Manage What You Don't Measure). An irrigation audit primarily involves measuring the distribution uniformity (DU) and then acting on the results to improve the DU and saving money, decreasing water use, and improving turf quality all at once.

Irrigation DU is quantified by placing flat-bottomed, straight-sided water collection containers at regular intervals (every 6-10 ft.) on an irrigated area (putting green, tee complex, section of fairway, etc.). The irrigation is run for a set time and the amount of water in the collection vessels is measured. The DU is calculated by simply taking the average of the lowest 25% of the readings and dividing by the overall average. A simple example is shown below. Ideally, you'll have many more than eight measurements.

Each Collection Container Has A Water Amount.

1. 0.20 inches
2. 0.26 inches
3. 0.28 inches
4. 0.33 inches
5. 0.33 inches
6. 0.42 inches
7. 0.54 inches
8. 0.63 inches

Distribution Uniformity Formula

Average of lowest 25% = 0.23 inches

Overall average = 0.374 inches

Distribution uniformity (DU) = 0.23 ÷ 0.374 = 0.615 or 61.5%

A DU of 80 is considered about as good as it gets, and anything below 60 is generally frowned upon for golf turf. The DU is used to adjust run times, as more irrigation needs to be applied to the entire area to make sure the lowest 25% doesn't get too dry. This obviously means that the other 75% is over-irrigated to compensate for the lowest 25%. While this makes perfect sense on paper, there is usually more than meets the eye.

Recently at the O.J. Noer Facility, we learned that striving for a high DU is too simplistic at best, and can even do more harm than good in certain situations. We built a USGA-style sand green with a 1% surface slope in 2008. After a while, we noticed that the downslope side was constantly wetter than the upslope areas and finally mapped it with our GPS-equipped soil moisture probe (See Figure 1) in June of this year.

In fact, on the day in June when we made the map in Figure 1, the upslope moisture was around 15% while the downslope moisture was around 35%. Next, we tested the DU and found that it was 80%. So despite nearly perfect irrigation coverage the moisture uniformity in the soil was horrible.

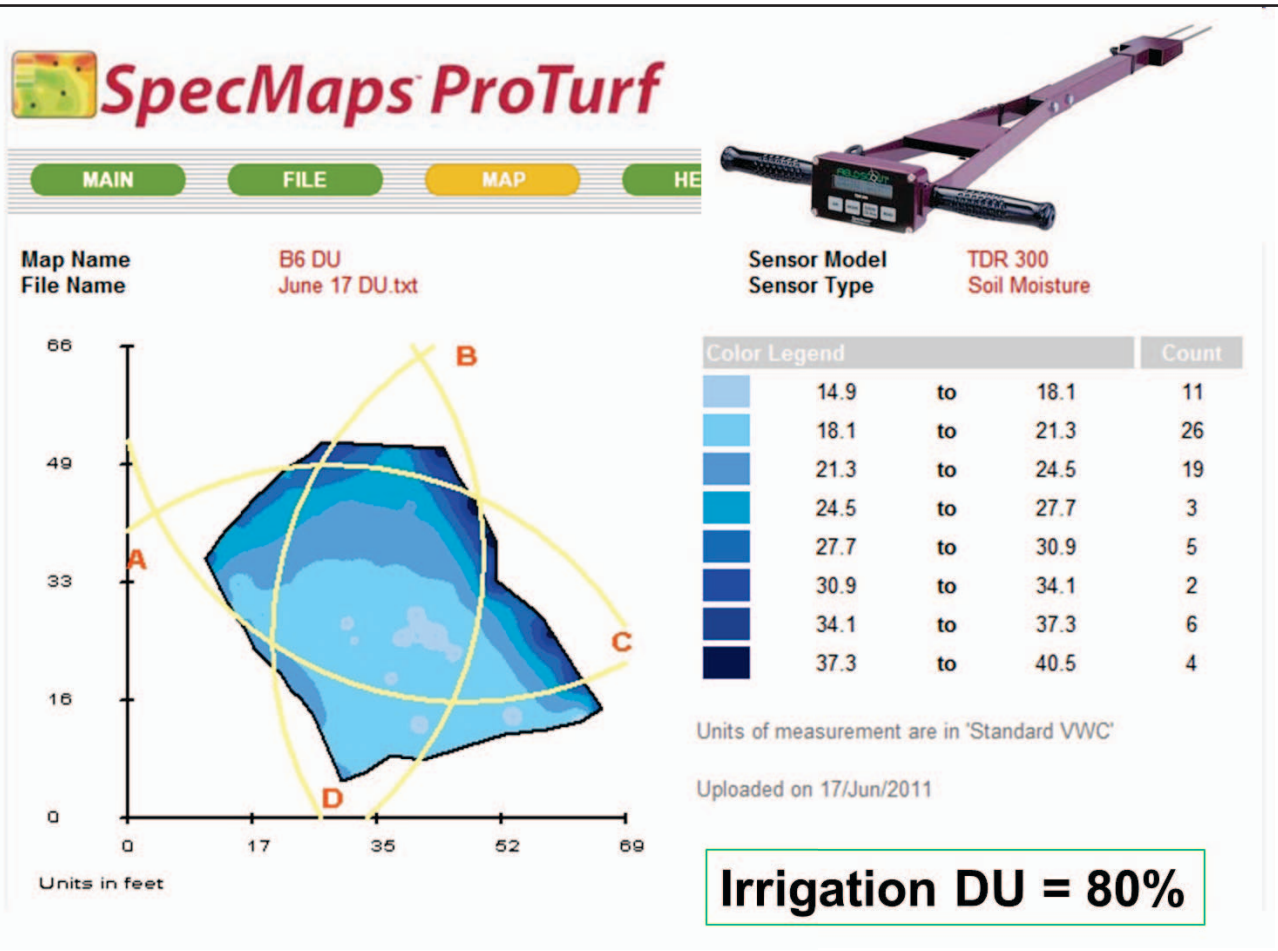

Figure 1. Soil moisture content of a USGA green with a 1% slope that slopes from "D" to "B". The letters are approximate locations of the irrigation heads and the yellow lines approximate their throw pattern. The "B" end was constantly wetter than the "D" side, despite nearly perfect irrigation distribution uniformity. This map was created with our GPS-enabled soil moisture probe and online mapping software.

Coming Events!

Fri Oct 7th and Sat Oct 8th - WGCSA Couples Weekend @ Minocqua CC, Minocqua, WI (w/NGLGCSA)

Monday October 3rd - WTA Fundraiser @ Oconomowoc GC, Oconomowoc, WI

Tuesday October 25th - WGCSA Assistants Fall Wrap Up Meeting @ OJ Noer Research Facility, Madison

Tues Nov 15th & Wed Nov 16th - WGCSA Golf Turf Symposium @ American Club, Kohler

So, we made an adjustment and capped off the irrigation head at the downslope side. We came back about a month later, measured the soil moisture and measured the irrigation DU with only three heads operating (See Figure 2). The DU was now only 12%, but the moisture content of the soil was visibly more uniform. Interestingly, the wettest point on the green remained the downslope area nearest the head that was capped off. This is likely because of rainfall events, and subsurface flow/drainage from the higher points in the soil to the lower spots.

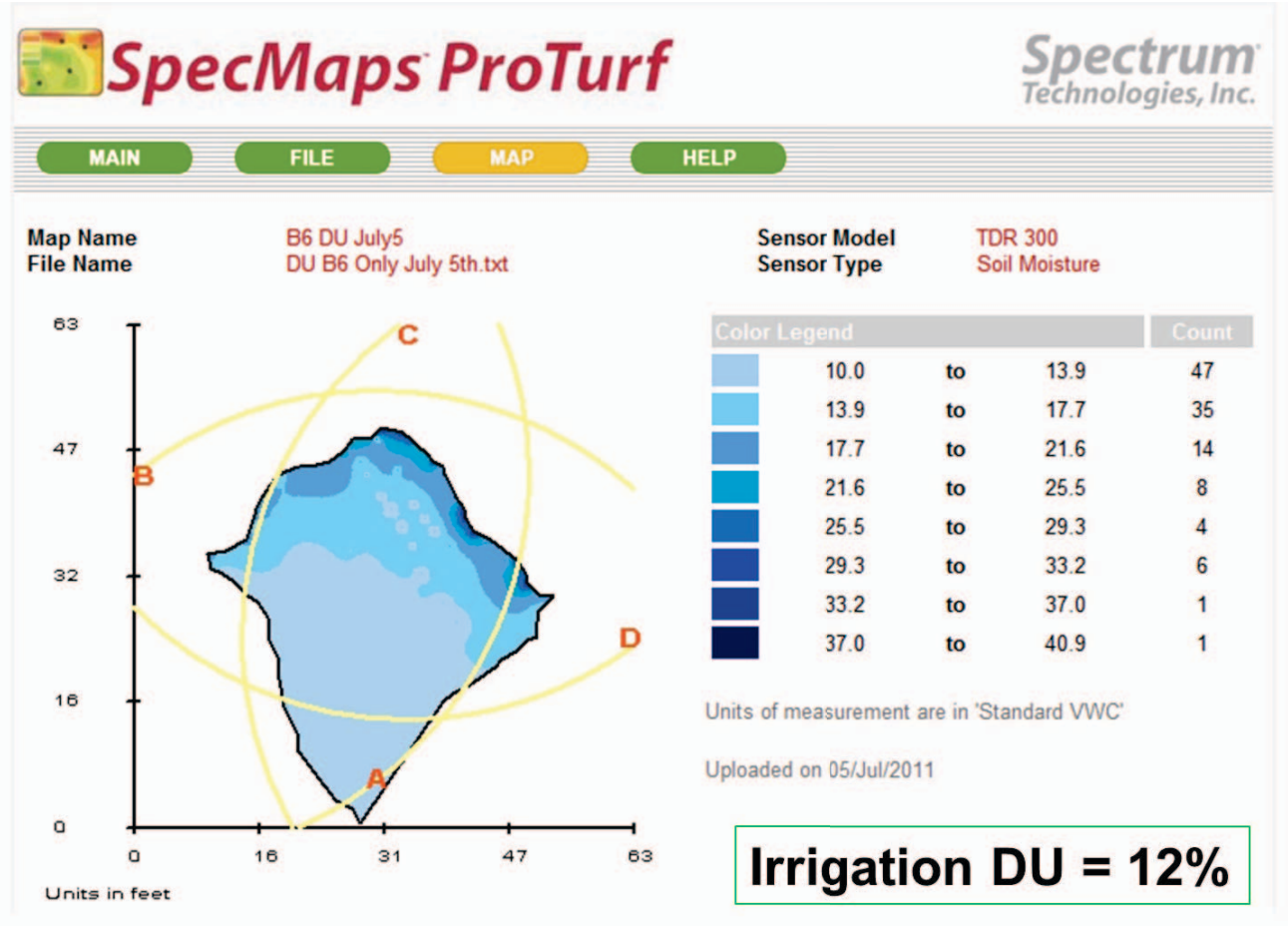

Figure 2. Soil moisture content of the same putting green shown in Figure 1 with the irrigation head at point "C" turned off for a month (downslope side). The irrigation DU was ridiculously low by any standard, yet the soil moisture distribution is visibly more uniform than shown in Figure 1. Interestingly, the wettest point on the green is nearest to the head that was turned off. This is because of rainfall and also subsurface drainage from higher points of the green.

Clearly, irrigation DU is only a tiny piece of the water management puzzle. By ignoring the actual water content patterns in the soil, achieving a high DU is a meaningless activity. In fact, in this example the turf manager should be striving towards a lower DU, as a means to improve the moisture distribution of the green.

Soils are not flat, uniform bodies. They are highly varied and have different drainage rates, particle distributions, and slopes, among other things. Remember, you are growing plants in the soil and the goal should be to have even moisture distribution in the soil, not necessarily coming out of the irrigation heads.